

BODY FAT, BODY WATER, AND TOTAL CALORIC VALUE OF UINTA GROUND SQUIRRELS

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ABSTRACT.— The weight of body water and fat-free dry weight of Uinta ground squirrels (*Spermophilus armatus*) is given as a function of body weight. Body fat is presented as a function of body weight and body length. An equation for calculating the total caloric content of Uinta ground squirrels is given.

Fat index (weight of fat/fat-free dry weight) values of juveniles increased from 0.11 to 0.22 from 5 June to 28 July. In male yearlings and adults the fat index increased about 8 to 9 times in the latter half of June and early July.

Uinta ground squirrels (*Spermophilus armatus*) spend about 8.5 months of their annual cycle in hibernation. In northern Utah adult squirrels begin entering hibernation in July, and all squirrels have disappeared by early September (Knopf and Balph 1977). Fat is utilized as the primary source of energy during hibernation. This study measured the body fat of squirrels over several weeks prior to hibernation.

METHODS

Thirty-eight male (ranging in body weight from 54.7 to 549.0 g) and 20 female (ranging from 57.4 to 554.0 g) Uinta ground squirrels were trapped along the Sinks Road in Franklin Basin, Cache County, Utah. They were transported to the laboratory and asphyxiated with carbon tetrachloride fumes, weighed, and stored in a freezer at -18 C. Weeks later, they were thawed, cut open, and desiccated to constant weight by freeze drying for 5 to 7 days. Each dried carcass was cut into smaller pieces, the fat content of each was extracted in a Soxhlet apparatus using petroleum ether (B.P. 60–80 C) as the solvent, and then each carcass was dried to constant weight in a hot-air oven at 80 C. The weight of body water was considered equal to the body weight at capture minus the vacuum-dried weight. The weight of body fat was equated with the vacuum-dried weight minus the dry weight of the fat-extracted carcass (i.e., the fat-free dry weight).

Body length and head width were measured, respectively, from the tip of the nose to the tip of the tail and at the widest point on the head, just posterior to the eyes.

A stepwise multiple regression analysis was used to derive equations relating each of the three parameters (body water, body fat, and fat-free dry weight) to body weight, body length, and head width.

Fat-extracted carcasses were ground in a Wiley mill and samples bombed in a Parr adiabatic bomb calorimeter.

RESULTS AND DISCUSSION

The accuracy of predicting body water (B_{H_2O}) and fat-free dry weight (FFDW) from three variables (body weight, body length, and head width) was not significantly better than that from body weight alone:

$$(1) B_{H_2O} = 37.48 + 0.5286 BW \quad r^2 = 0.933$$

$$(2) FFDW = 0.8149 + 0.2327 BW \quad r^2 = 0.958$$

Where B_{H_2O} , FFDW and BW are in grams

The equation related body fat (BF) to both weight and body length (BL) and the highest r^2 value:

$$(3) BF = 137.23 + 0.5342 BW - 0.9488 BL \quad r^2 = 0.853$$

Where BF is in grams and BL is in mm.

The coefficient of determination (r^2) between BF and body weight alone was 0.645.

The mean g-caloric value of the fat-free dry carcasses of 10 male and 9 female squirrels was 4601 kcal/g (SD = 573) and 4353 kcal/g (SD = 824), respectively. The total ca-

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TABLE 1. Mean fat index of Uinta ground squirrels captured in Cache County, Utah.

Date of capture	Mean fat index (Weight of fat/fat-free dry weight) \pm SD of			
	Juveniles	Yearlings and adults		
		Males	Females	
			Not nursing	Nursing
5 June	0.11 \pm .05 N = 9			
12 June	0.04 \pm .00 N = 3	0.11 \pm .03 N = 11	0.23 \pm .00 N = 2	0.09 \pm .06 N = 3
4 July	0.10 \pm .03 N = 2	1.02 \pm .04 N = 3	0.83 N = 1	
8 July	0.12 \pm .09 N = 3	.88 \pm .57 N = 5	0.76 \pm .15 N = 2	
15 July	0.22 \pm .12 N = 6			
28 July	0.22 \pm .08 N = 7			

loric value (TCV in kcal) of a Uinta ground squirrel can be estimated from its body weight and body length from Eq. 4.

$$(4) \text{ TCV} = 9.3 \text{ BF} + \text{FFDW} \\ \times (4601 \text{ for males or } 4353 \text{ for females}), \\ \text{where BF and FFDW are computed from Eq. 3 and} \\ \text{Eq. 2, respectively.}$$

In the first half of June the fat index (weight of fat/fat-free dry weight) for yearling and adult squirrels and juveniles is not significantly different, but the rate of fat deposition within the next 30 days is about five times greater among yearlings and adults (Table 1), which normally begin to enter hibernation in early July.

Fat indices of males and females in my study were not significantly different, but the sample sizes are probably too small to uncover any real differences. In mid-June the fat index of lactating females (\bar{x} = .092; SD = .064) was significantly lower (t = 3.83, df =

2; p = 0.06) than that of nonlactating females (\bar{x} = .233; SD = .002).

The body water index (weight of body water/weight of fat-free dry weight) for juveniles (\bar{x} = 3.80; SD = 0.102) is significantly greater (t = 12.99; df = 20; p < .001) than for yearlings and adults (\bar{x} = 2.821; SD = 0.275) in the first half of June, and remains higher for the next month.

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LITERATURE CITED

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